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Attentional Focus

Contributors: Gabriele Wulf
Editors: Robert C. Eklund & Gershon Tenenbaum
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The effect of an individual's focus of attention on motor performance and learning has long intrigued both researchers and practitioners. Numerous studies have shown that what a performer focuses or concentrates on while executing a motor skill has an impact how well that person performs the skill. An important distinction is that between an *external focus* of attention on the intended movement effect, as on an implement versus an *internal focus* on body movements. These foci have differential effects on motor performance—sometimes seen almost immediately—as well as more long-term effects on motor learning. There is considerable evidence for the superiority of an external focus of attention with respect to both the effectiveness and efficiency of movements.

Movement Effectiveness

Numerous studies have assessed movement effectiveness as a function of attentional focus using outcome measures such as deviations from a balanced position, the accuracy in hitting a target or producing forces, or movement speed. The first study, by Gabriele Wulf and Rebecca Lewthwaite, demonstrated learning advantages of instructions inducing an external relative to an internal focus of attention using dynamic balance tasks. The results showed that the learning of those tasks was enhanced when participants' attention was directed to the movements of the platform on which they were standing as compared to the movements of their feet. Since then, numerous researchers have replicated the benefits of an external focus for other tasks.

Learning advantages of an external focus have also been shown for many sport skills, such as hitting golf balls, shooting basketball free throws, throwing darts, serving in volleyball or kicking in soccer, kayaking, swimming, and running. For **[p. 48 ↓]** example, the accuracy in hitting golf balls is greater when performers focus on the swing of the club or on the intended ball trajectory (external focus), rather than on the swing of their arms or on their wrists (internal focus). Similarly, in dart throwing, accuracy is increased with an external focus on the flight of the dart or bull's eye. In swimming or running, performance (speed) is enhanced when performers focus on the force they are exerting against the water or ground as opposed to the movement of their arms or legs exerting the force, respectively. When the goal is to produce a certain

amount of force, concentrating on the device, such as a weight bar or force platform, against which the force is exerted generally results in greater accuracy than focusing on the effector, such as the arms or legs.

Interestingly, when the effectiveness of external and internal focus conditions is compared to that of control conditions without focus instructions, performance in the control condition is typically similar to that with internal focus instructions, and external focus instructions result in more effective outcomes than both. One possible reason for this result is that people spontaneously focus on their body movements if they are not specifically asked to adopt an external focus. The only exception to this pattern of results is sometimes seen with highly skilled athletes who show similar performances in external focus and control conditions but degraded performance with an internal focus. This pattern of results suggests that—aside from relatively rare cases in which performance is already highly automatized (see below)—an external focus *enhances* performance or learning.

An intriguing finding is the so-called *distance effect.* Some studies have compared the effectiveness of external foci that differed with respect to the distance of the intended movement effect from the body. For example, a task may involve a balance platform that has markers attached to it, and learners are asked to concentrate on the markers while keeping the platform horizontal. Performers whose markers are placed at a greater distance from their feet show more effective balance learning than performers who are asked to focus on markers that are closer to their feet. Greater benefits of more distal relative to more proximal external foci have also been found for kayaking, golf, dart throwing, and long jump. Thus, concentrating on a movement effect that is more remote from one's body movements seems to be even more advantageous than a focus on an effect that is closer to the body.

Overall, the benefits of an external compared to an internal focus have been shown not only for a variety of skills but also levels of expertise and age groups, as well as healthy individuals and those with motor impairments (for a review, see Wulf, 2012).

Movement Efficiency

If the same movement outcome is achieved with less energy, the movement is considered more efficient. While some studies have used direct measures of efficiency, such as muscular activity or oxygen consumption, others have used more indirect measures such as maximum force production, movement speed, or endurance to examine the effects of attentional focus. If more effective outcomes (e.g., greater forces) are achieved with the same (physical) resources, they reflect greater movement efficiency as well. There is converging evidence that an external relative to an internal focus optimizes movement efficiency.

Muscular Activity

For weight lifting tasks, electromyographic (EMG) activity has been found to be reduced when performers concentrate on the weight they are lifting (external focus) as compared to their arms or legs that are lifting the weight (internal focus), or compared to lifting without an instructed focus (control conditions). An external focus has been shown to be associated with greater efficiency *within* muscles, as only the necessary motor units are recruited, whereas superfluous recruitment of larger motor units is seen when performers adopt an internal focus. In addition, fewer cocontractions between the agonist and antagonist muscles occur with an external focus, indicating a more efficient coordination *between* muscle groups. As a result, performers are able to execute more repetitions with the same weight or produce greater maximum force (see below) with an external focus.

Reduced EMG activity has also been found for tasks requiring accuracy such as free-throw shooting in basketball or dart throwing, when performers concentrate on the target as opposed to their arm. Interestingly, with an internal focus, increased EMG activity is seen not only in those muscles on which the performer focuses but also in other muscle groups—indicating that a focus **[p. 49 ↓]** on one part of the body *spreads* to other muscle groups. Thus, movement inefficiency is increased at a more general

level, presumably contributing to the greater observed inaccuracies in the movement outcome with an internal focus.

Oxygen Consumption and Heart Rate

If the same (or more effective) movement outcome is achieved with less muscular activity, cardiovascular responses should be lowered as well. Indeed, studies confirm this assumption. In experienced runners who ran on a treadmill at a certain speed, oxygen uptake was reduced with an external focus (on the surrounding environment) relative to internal foci (on running technique or breathing). Furthermore, lower heart rates have been found when exercisers adopted an external relative to an internal focus while performing sit-ups.

Maximum Force Production

Producing maximum forces requires optimal muscle fiber recruitment within muscles and optimal activation patterns among muscles. Studies examining maximum force production demonstrate differences in muscular coordination as a function of attentional focus. Greater maximum forces with an external focus have been found for isokinetic contractions (e.g., biceps contractions on a dynamometer) and for dynamic tasks such as vertical jumps and standing long jumps. Also, complex tasks such as discus throwing benefit from an external focus (discus) as opposed to an internal focus (throwing arm or hand).

Speed and Endurance

Movement speed has been found to be increased for an external focus compared with an internal one, presumably due to the greater movement efficiency associated with an external focus. The tasks used to demonstrate this advantage have ranged from functional reach tasks in persons following cerebrovascular accident (stroke) where a focus on the manipulated object resulted on more fluid and faster motions than a focus on the grasping hand, to riding a paddle boat powered by pedals (Pedalo) in young

healthy adults, where focusing on the boards under their feet led to higher speeds than focusing on the feet themselves.

In longer duration tasks in which fatigue is a limiting factor, the adoption of an external focus can enhance performance as well. In tasks that require the production of submaximal or maximal forces over a longer period of time, an external focus enables performers to maintain those forces longer or to produce greater force in a given period of time (e.g., 10 secs). Performance on sprinting and agility tasks involving running and turning components has been shown to be enhanced by external focus instructions, relative to internal focus or no instructions. Similarly, (intermediate) swimmers swim faster when they focus on pushing the water back as opposed to pulling their hands back.

Also, the attentional focus of exercisers has an influence on muscular endurance. Trained individuals performing various exercises like bench press or squat lift were able to complete a greater number of repetitions to failure with a given weight when instructed to focus on the weight as opposed to the movements of the limbs involved or without focus instructions. In a study using an isometric force production task (wall-sit), participants' ability to hold the posture increased with an external focus (imaginary horizontal lines between their hips and knees), relative to an internal focus on the horizontal position of their thighs.

Mechanisms Underlying the Attentional Focus Effect

An internal focus induces a conscious type of control, causing individuals to constrain their motor system (*constrained action hypothesis*) and interfere with automatic control processes that have the capacity to control movements effectively and efficiently. In contrast, an external focus promotes an automatic mode of control. Adopting an external focus allows unconscious, fast, and reflexive processes to control the movement, with the result that the desired outcome is achieved effectively and relatively effortlessly. Several converging lines of evidence support the notion that an external focus facilitates automaticity relative to a focus on body movements. For example,

attentional-capacity demands have been shown to be reduced with an external focus. High-frequency movement adjustments while balancing with an external focus indicate the use of reflex-based feedback loops, while slower and more conscious feedback loops seem to be utilized with an internal focus. Other findings, such as the reduced EMG activity seen with an external focus, also indicate that an external focus allows individuals to perform at the higher, more **[p. 50 ↓]** advanced level—essentially reflecting a speeded learning process.

Conclusion

The benefits of an external compared with an internal focus have been shown for a variety of skills, ranging from pressing keys to driving golf balls. They have also been found for different levels of expertise, ranging from novice to skilled performance; for people of various age groups, ranging from children to older adults; and for healthy people as well as those with injuries or with motor impairments (stroke, Parkinson's disease, intellectual disabilities). Performance-enhancing effects of an external focus are often seen immediately, but practice with an external focus also has more permanent effects on motor skill learning. These effects are seen in movement effectiveness like accuracy, consistency, and balance as well as movement efficiency like EMG, heart rate, force production, speed, and endurance. Adopting an external focus during practice promotes movement automaticity and accelerates the learning process. In practical settings, coaches, trainers, and physical therapists often use lessthan-optimal instructions and feedback by referring to body movements, thus inducing an internal focus. Rewording instructions to direct performers' attention to the intended movement outcome, and away from body movements, has the potential to significantly enhance performance and learning.

Gabriele Wulf

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See also

- Attention Theory
- Attention Training

- Attentional Focus
- Attention–Performance Relationships
- Feedback

Further Readings

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